SIEMENS

LITHOSTAR Multiline

	SP.
Panair Instructions	
Repair Instructions	
Shock wave system	
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	English

Print No.: RXL2-120.841.01.02.02

Doc. Gen. Date: 09.05

Replaces: RXL2-120.841.01.01.02

0 - 2 Revision

Chapter	Page	Revision
all	all	02

Document revision level

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General 1 - 1

Safety notes



When performing all service work and tests, please note the product-specific safety information contained in the instructions, as well as the general safety information contained in ARTD Part 2.

Tests or adjustments performed with radiation ON are identified by the radiation warning symbol \bigwedge .

Radiation protection regulations must be observed and radiation protection clothing must be worn during these types of adjustments.

Observe ESD regulations.

Measurement instruments required

NOTICE

Unless otherwise specified, the articles mentioned are listed in the STC (Service Tools Catalog). The STC is a component of the Spare Parts Catalog.

•	Oscilloscope e.g. Fluke Scope Meter	73 92 074
•	Digital Multimeter e.g. Fluke 187	99 94 831
•	Shock wave pressure test device	30 95 408
•	Adapter	70 41 028

Technical documents required

 Disposal instructions 	RXL2-120.163.01
 Isocenter Adjustment 	RXL2-120.071.01
 Shock Wave Pressure and Position Control 	SPL2-120.074.01

Reading/deleting the shot counter

Shot counter: Reading → Monitoring (Service Software Multiline)

Instructions RXL2-120.113.01...

Deleting → Parameter (Service Software Multiline)

Interface: Shock wave System Instructions: RXL2-120.032.01...

Documentation of the shot counters \rightarrow Operating record (Logbook)

1 - 2 General

Overview of components

	Modul	е	Comments on replacement			
Function Part number			Comments on replacement			
D1	Power supply	11 64 032 X1767	0V = Z6 + 15 = Z10 - 15V = Z32 Set +15 V ± 0.1 V with R2 Set - 15 V ± 0.1 V with R5			
D12	Trigger electro- nics	87 98 547 J1009	No special attention required			
D19	Monitoring	16 65 194 J1038	Check settings and adjust if necessary: Refer to wiring diagram J1029-39			
D91	Energy monito- ring	88 57 245 J1005	Check settings and adjust if necessary: Refer to wiring diagram J1029-91			
W11A	Cooling circuit	16 65 533 J1011	Check flow rate setting and adjust with R5 if necessary: Refer to wiring diagram J1029-31			
W12	Coupling control	16 65 277 J1029	Check prom's and jumpers, Check setting and adjust if necessary: Refer to wiring diagram J1029-33, jumper log			
W15	Charging device control	16 65 558 J1038	Check proms and jumpers, Refer to wiring diagram J1029-10, jumper log			
W16	Interface	16 65 368 J1038	Check proms and jumpers, Refer to wiring diagram J1029-10			
	Sensor module shock wave head	30 92 603 J1035	Check setting on boards W11A and W12			
B3/W4	Pressure trans- ducer sensor B3/W4	30 93 551 J1029	Check setting on board W12			
M15	Water pump	30 95 044 J1029	Check flow and set 25 ± 3 liters on W11A with R5			
M18	Charging device	46 81 326 B3305	Check setting of board D91 Documentation of the "System counter"			
N70	Shock wave generator 11 78 230 J1003		Check setting of board D91, note counter reading of the "Shock wave/ Spark gap counter" and perform reset. Perform pressure measurement according to instructions SPL2-120.074.01			

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General 1 - 3

Mod	ule	0
Function	Part number	Comments on replacement
Spark gap	89 56 112 J1003	Do not touch the ceramic body. Record counter reading of the "Shock wave/ Spark gap counter" and perform reset
		To prime the spark gap select the highest energy level and release 500 ± 10 shock waves If errors occur, reset these and release further
		shock waves
Cooling unit	46 94 022 B3104	Fill the cooling circuit acc. to Chapter 1
Shock wave head	30 92 223 J1035	The shock wave head is delivered without coupling bellows
Cone drive	16 69 275 J1035, 30 92 728 J1035	_
Filter insert	70 52 012 F0428	Fill the cooling circuit acc. to Chapter 1
Filter complete	30 95 010 J1029	Fill the cooling circuit acc. to Chapter 1
Pressure switch S4	30 93 528 J1029	Fill the cooling circuit acc. to Chapter 1
Solenoid valve Y1	77 60 341 B1805	Fill the cooling circuit acc. to Chapter 1 Use the water connections of the old valve
Flow meter	70 54 257 F0423	Fill the cooling circuit acc. to Chapter 1
High voltage socket	30 92 009 J1035	Remove shock wave head cover acc. to Chapter 1
Coupling bellows	47 78 465 J1035	After replacement, fill the coupling circuit acc. to Chapter 1
Ultrasound cap assembly	30 92 207 J1035	

1 - 4 General

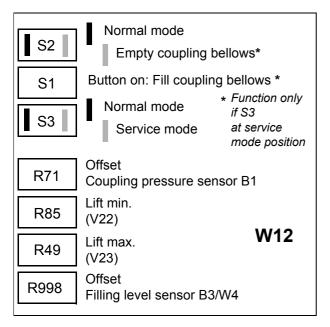


Fig. 1

Removing the shock wave head cover

• System ON.

Actuate the following switches on board W12 (Fig. 1): S3 in SERVICE MODE position. S2 in EMPTY COUPLING BELLOWS position (valve Y3 opened).

NOTICE

More water remains on the lens with the new coupling bellows, therefore, use caution when removing it.

- Move the shock wave head into working position.
- Switch module N12 off with S1.
- Remove the left side cover on the unit.

On systems:

up to and including serial no.06032:

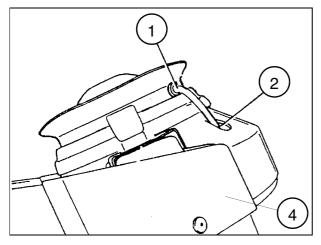
- Loosen hoses 5 and 8 on the water interface in the shock wave cabinet.
- Connect the service hoses to hose connections 5 and 8 coming from the unit and place the ends in a collecting vessel.

On systems: from serial no. 06033:

 Connect the service hoses to the T connector of the water interface in the shock wave cabinet and place the ends in a collecting vessel.

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General 1 - 5



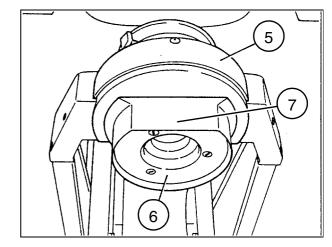
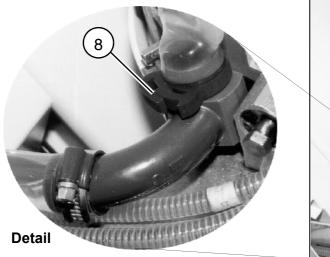


Fig. 2 Fig. 3



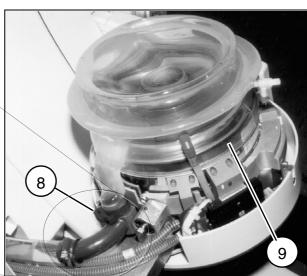


Fig. 4

- Remove the cover from the upper cover (2/Fig. 2) for the elbow pipe.
- Remove the elbow pipe (1/Fig. 2) from the coupling bellows.
- Remove the upper cover (5/Fig. 3).
- Remove the middle cover (7/Fig. 3).
- Remove the lower cover (6/Fig. 3).

Removing the coupling bellows

- Remove the shock wave head cover.
- Remove the covering (as shown in 4/Fig. 2).
- Remove the clamp (as shown in 8/Fig. 4).
- Remove the water connection of the coupling bellows.

1 - 6 General

• Remove the tensioning band found below the collar (9/Fig. 4), to do so, bend the collar upwards.

Remove the coupling bellows from the shock wave head.

∆CAUTION

There is still water on the lens.

Attaching the coupling bellows

- Dry the lens, if necessary, so that the coupling bellows can be attached more easily.
- Mount the coupling bellows, and ensure its correct position.
 The connection for the pressure sensor (elbow) in the coupling bellows must be congruent with the lens opening.
- Thread the tensioning band through the guide so that the closure on the tensioning band is on the opposite side of the water connection.
- Place the water connection of the coupling bellows onto the connecting piece, using the hose clamp (8/Fig. 4) to secure it.
- Reinstall the cover and the shock wave head covering (4/Fig. 2).

Installing the shock wave head covers

- Attach the central cover.
- Position and secure the upper cover.
- Reconnect water hoses 5 and 8 to the interface in the shock wave cabinet or remove the service hoses.
- Switch on module N12.
- Fill the cooling circuit and the coupling circuit according to Chapter 1.
- System OFF.
- Reattach the lower cover (6/Fig. 3).
- Reattach the left side cover on the unit.

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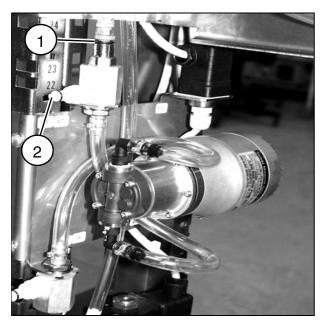


Fig. 5

Filling/venting the cooling circuit

∆CAUTION

Each time the cooling circuit is opened, it must be filled or vented.

- Fill the water canister with sterile water (deionized water is **not** sterile. Refer to Speedinfo RX17-96).
- Hook the filled canister in the cabinet onto the transport holder.

NOTICE

The canister must not be closed tightly due to venting. Board W11 must be set as described in Chapter 2 of this manual. When using the lwaki pump, the cooling circuit must be opened in order for the pump to draw in.

- Open the red cap on the fast venting valve.
- Open the pump outlet quick coupling (1/Fig. 5). If service hoses are available, then these can be connected to the T piece of the water interface (2/Fig. 5).
- Switch on module N12 with switch S1; the cooling circuit will now be filled and vented.
- Switch off the module N12 with switch S1.
- Connect pump quick coupling or remove service hoses.
- Switch on the module N12 with switch S1.
- If pump M15 and valve Y1 begin to oscillate, i.e. if they constantly switch on and off, then pull the plug of valve Y1 briefly several times until pump M15 runs evenly.

1 - 8 General

• Allow the air bubbles to escape from both cooling circuits by alternately pressing one circuit closed for approx. 10 min. with a hose clamp at the cooling unit (OT and Litho) and increasing the flow with R5 on board W11A to 40l/h (+3l/h).

- During venting, move the shock wave head several times from the park position into the working position and back again to facilitate removal of air bubbles.
- After the cooling circuit is vented, i.e. once air bubbles can no longer be seen in the flow meter, set the flow back to 25 l/h (+3l/h) with R 5 on board W11A.
- If necessary, set switch S1 (a/Fig. 6) on the flow meter to approx. 20 l/h.
 The LED V3 on board W 11A must light up after ending the filling and emptying process.
- Disconnect the mains plug of the cooling devices.
- Connect a multimeter to measurement point X3 on board W11A, from AS02 Mp X2.3, (0V on board D1.X3) and measure the value.

The value must not change by more than 50 mV within 10 minutes.

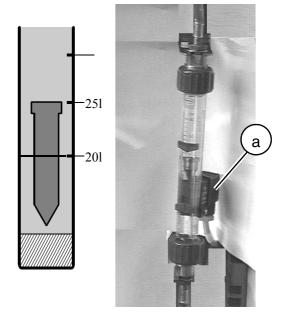


Fig. 6

- If the deviation is larger, check whether there are still air bubbles in the system.
- Check the system for leaks.
- Close the red cap of the fast venting valve.
- Reconnect the mains plug of the cooling unit.

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Filling the coupling circuit

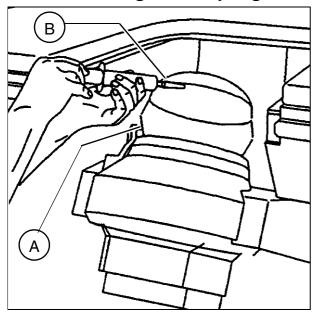


Fig. 7

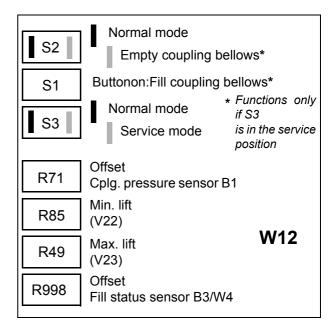
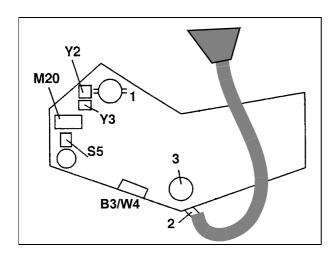


Fig. 8



- Press the coupling bellows together.
- Insert and secure the elbow pipe (A/Fig. 7).
- Move switch S2 (Fig. 8) on board W12 into the NORMAL MODE position
- With button S1 on board W12 (Fig. 8), fill the coupling bellows with enough water so that the air collected in the coupling bellows can be removed.
- Remove the air in the coupling bellows using a syringe without a needle (B/Fig. 7).
- Move switch S2 into the EMPTY COUPLING BELLOWS position on board W12.

Fig. 9

- Once the coupling bellows has completely collapsed, check the water level. It should be between the two lines shown in (1/Fig. 9).
 - Small quantities of water can be removed or replenished with the syringe.
- Move switches S3 and S2 back into the normal mode position on board W12.

1 - 10 General

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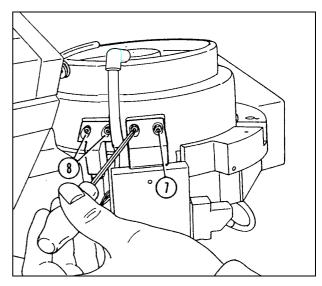


Fig. 1

- Remove the shock wave head cover (refer to Chapter 1).
- Remove the sensor module (7/Fig. 1) by removing the screws.
 - The cooling water will drain out of the shock wave head.
- Disconnect the plug from pump M15 (do not run the pump without water).
- Replace board W11.
- Switch on module N 12.

NOTICE

There are two different versions of board W11. The measurement point designations are different for each version.

Board W11 with AS00 and AS01

- Connect a multimeter to board W11A at measurement point X3 (0V to board D1.X3).
- Check voltage 0 V ± 10 mV and adjust with R22, if necessary.
- Measure the room temperature.
- Connect the multimeter to board W11A at measurement point X2 (0V to board D1.X3).
- Check whether the measured voltage agrees with the temperature value from the following table:

Voltage tolerance ± 30 mV; adjusted with R13 on board W11A

° C	18° C	19° C	20° C	21° C	22° C	23° C	24° C	25° C	26° C
Volt	4.51 V	4.70 V	4.90 V	5.10 V	5.29 V	5.49 V	5.69 V	5.89 V	6.09 V
°F	64° F	66° F	68° F	70° F	72° F	73° F	75° F	77° F	79° F
°C	27° C	28° C	29° C	30° C	31° C	32° C	33° C	34° C	35° C

°C	; 27° C	28° C	29° C	30° C	31° C	32° C	33° C	34° C	35° C
Vo	t 6.29 V	6.49 V	6.69 V	6.89 V	7.09 V	7.29 V	7.49 V	7.69 V	7.90 V
° F	81° F	82° F	84° F	86° F	88° F	90° F	91° F	93° F	95° F

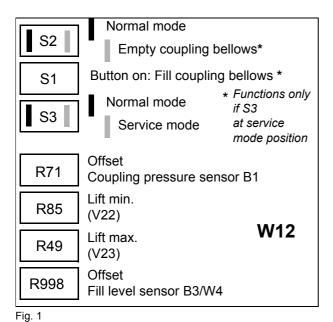
Board W11 as of AS02

- Connect a multimeter to board W11A at measurement point X2.3 (0V to board D1.X3).
- Check voltage 3V ± 10 mV and adjust with R22, if necessary.
- Measure the room temperature.
- Connect the multimeter to board W11A at measurement point X2.2 and 0 V to board D1 at measurement point X3.
- Check whether the measured voltage agrees with the temperature value in the following table:

Voltage tolerance ± 30 mV; adjustable with R13 on board W11A

° C	18° C	19° C	20° C	21° C	22° C	23° C	24° C	25° C	26° C
Volt	4.36 V	4.53 V	4.69 V	4.85 V	5.01 V	5.17 V	5.33 V	5.50 V	5.66 V
°F	64° F	66° F	68° F	70° F	72° F	73° F	75° F	77° F	79° F

° C	27° C	28° C	29° C	30° C	31° C	32° C	33° C	34° C	35° C
Volt	5.82 V	5.98 V	6.14 V	6.31 V	6.47 V	6.63 V	6.79 V	6.95 V	7.11 V
°F	81° F	82° F	84° F	86° F	88° F	90° F	91° F	93° F	95° F



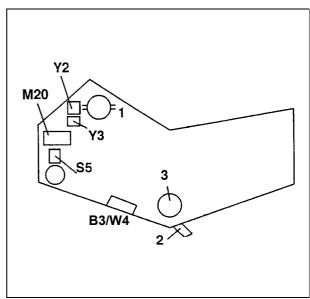


Fig. 2

- Remove the left side cover of the unit.
- System ON.
- Move the shock wave head into the gel position.
- Actuate the following switches on board W12 (Fig. 1):
 - S3 in SERVICE MODE position
 - S2 in EMPTY COUPLING BELLOWS position (valve Y3 open)
- Remove the elbow pipe (pressure sensor) at the coupling bellows.
- Connect the multimeter to board W12 at measurement point X3.1 (0 V to board D1.X3).
- Check whether the measured voltage is 1.0 V & 0.01 V at measurement point X3.1. This can be adjusted with R71 on board W12.
- Fill the coupling circuit. Refer to Chapter 1.
- Connect the multimeter to measurement point X3.4 on board W12, (0V on board D1 X3).
- Actuate the following switches on board W12 (Fig. 1):
 - S3 in SERVICE MODE position
 - S2 in EMPTY COUPLING BELLOWS position (valve Y3 open)
- Check whether 1.0 V ± 10 mV are present at measurement point X3.4 (fill level sensor B3/W4) on board W12 (0V to board D1.X3). This can be adjusted with R998 on board W12

NOTICE

The setting can vary by \pm 100mV in operation. Reason: Complete decoupling is not accurately reproducible.

• Set the service switch S2 (Fig. 1) into the NORMAL MODE position.

- Actuate button S1several times briefly to gradually fill the coupling bellows until 2.5 V ± 0.1 V are present at measurement point X3.4. If necessary, drain off excess water by actuating switch S2.
- Turn potentiometer R85 clockwise (cw) until V22 **just lights up** (i.e. the setting is on the verge) to attain the **lift minimum**.

NOTICE

If V22 is already lit, then turn potentiometer R85 counterclockwise (ccw) until V22 just lights up.

- Connect the multimeter to X3.1 on board W12 (0V on board D1 X3).
- Actuate button S1 several times briefly to gradually fill the coupling bellows until 3.0 V ± 0.1 V are present at measurement point X3.1. If necessary, drain off excess water by actuating switch S2.
- Turn potentiometer R49 counterclockwise (ccw) until V23 just lights up and to attain the lift maximum.

NOTICE

If V23 is already lit, turn potentiometer R49 clockwise (cw), until V23 just lights up.

Control measurement:

Connect the multimeter to X3.4 on board W12 (0V to board D1.X3).

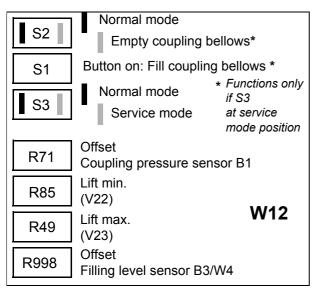
Display on the multimeter £ 10.5 V

- Set switch S3 to the NORMAL MODE position (Fig.1) on board W12.
- Select the smallest coupling stage on the operating PC.
- Bring the shock wave head into the therapy position.
- Once the filling process is ended, V23 (lift maximum) and V20 (pressure too low) must light up.

⚠CAUTION

No counterpressure may be exerted on the coupling bellows.

- Move the shock wave head into the park position and reattach the left side cover.
- · System OFF.



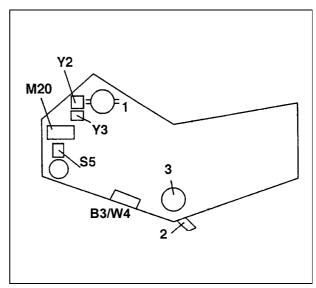


Fig. 2

- Remove the left side cover from the unit.
- System ON

Fig. 1

- Move the shock wave head into the gel position.
- Connect the water hose for emptying the water tank (2/Fig. 2).
- Actuate the following switches on board W12 (Fig. 1):
 - S3 in SERVICE MODE position
 - S2 in EMPTY COUPLING BELLOWS position (valve Y3 open)
- Let the all the water empty out of the water tank.
- System OFF.
- Loosen the retaining plate for board D32.
- Tilt the retaining plate toward the front. The cables do not have to be removed for this purpose.
- Loosen the two mounting screws of the pressure sensor.
- Check the hose underneath the sensor for remaining water and, if present, dry it off.
- Pull the pressure sensor out toward the front and desolder the cables or disconnect the plug. (Label the individual wires before desoldering.)
- Solder the new pressure sensor or connect the plug, however, do not install it yet.

	Connection wire without plug	Connection wire with plug
Sensor B3 without board	Solder the wires.	
Sensor B3/W4 with board	Sensor out → X3 Sensor GND → X4 Sensor INT → X2	Connect the plug.

Attach board W12 to the extension.

4 - 2 Replacing the pressure transducer sensor B3/W4

- Connect the multimeter to board W12.d14 (0 V on board W1.X3).
- System ON.
- The multimeter must read 1.8 Volt \pm 0.25V. If this is not the case, another pressure sensor must be installed.
- System OF.F
- Install the new pressure sensor B3/W4 reusing the O ring from the old pressure sensor.
- Reattach the retaining plate for board D32.
- Check that all cables are still connected to board D32.
- System ON.
- Actuate the following switches on board W12 (Fig. 1):
 - S3 in SERVICE MODE position
 - S2 in EMPTY COUPLING BELLOWS position (valve Y3 open)
- Connect the funnel for filling the water tank (2/Fig. 2).
- Fill the water tank with sterile water (deionized water is not sterile. Refer to Speedinfo RX 17-96) so that the water level is visible in the upper sight glass (1/Fig. 2).
- Remove the funnel (loosen the quick coupling on the water tank) (2/Fig. 2).
- Press the coupling bellows together and plug in and secure the pressure sensor again.
- Set switch S2 (Fig. 1) to NORMAL MODE (valve Y3 is closed).
- Using button S1 on board W12 (Fig. 1), fill the coupling bellows with water until the air collected in the coupling bellows is released.

⚠CAUTION

The water level in the water tank must not drop below the center of the lower sight glass (3/Fig. 2).

- Remove the air collected in the coupling bellows using a syringe (without needle).
- Set switch S2 (Fig. 1) to EMPTY COUPLING BELLOWS (valve Y3 is open).
- Connect the funnel for filling the water tank (2/Fig. 2).
- Fill up the water tank so that the water level is between the two lines in the upper sight glass shown in (1/Fig. 2)

∆CAUTION

Do not fill up the water tank until the coupling bellows has collapsed completely (a small amount of water will remain in the coupling bellows).

- Remove the funnel (loosen quick coupling on the water tank) (2/Fig. 2).
- Set switch S2 (Fig. 1) to NORMAL MODE (valve Y3 is closed).
- Actuate button S1 (Fig. 1) on board W12 (coupling bellows is filled with water).

∆CAUTION

The water level in the water tank must not drop below the center of the lower sight glass (3/Fig. 2).

Replacing the pressure transducer sensor B3/W4

- 4 3
- Remove any air bubbles in the coupling bellows with the syringe (without needle)
- Set switch S2 (Fig. 1) to EMPTY COUPLING BELLOWS (valve Y3 is open).
- Once the coupling bellows has collapsed **completely**, check whether the water level is between the lines on the upper sight glass.
- Remove or replenish small quantities of water with the syringe.
- Check that 1.0 V ± 10 mV are present at measurement point X3.4 (sensor B3/W4 filling level) on board W12.
 (0V on board D1.X3)

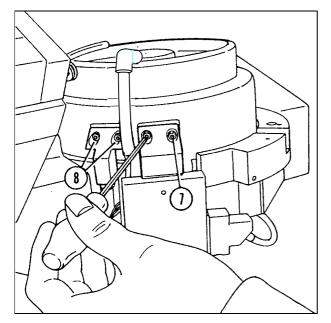
This can be adjusted with R998 on board W12.

NOTICE

The setting can vary by \pm 100 mV during operation. Reason: Complete decoupling of the coupling bellows is not accurately reproducible.

- On board W12 set switches S3 and S2 back to the NORMAL MODE position (Fig. 1).
- Move the shock wave head into the park position.
- Reattach the left side cover.
- System OFF.

Replacing the pressure transducer sensor B3/W4 4 - 4 This page intentionally left blank.



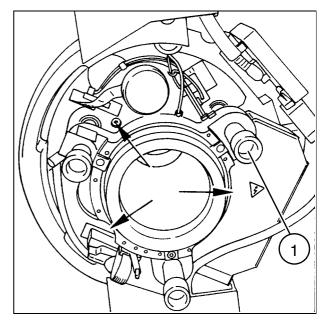


Fig. 1 Fig. 2

NOTICE

To inhibit the formation of algae, we recommend replacing the water each time the shock wave head or cone drive are replaced.

Preparation

- Remove the ultrasound applicator from the cone drive (if present).
- Remove the shock wave head cover (see Chapter 1).
- Remove the sensor module (7/Fig. 1) by removing the screws. The cooling water will drain out of the shock wave head.
- Remove connection (8/Fig. 1).

Replacing the shock wave head

Replacing cone drive

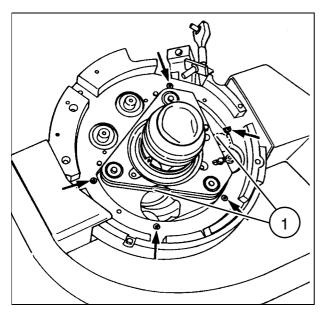
- Remove the coupling bellows according
 Remove the covering (4/Fig. 2 in Chapter 1).
 to Chapter 1.
 - Remove the clamp (8/Fig. 4 in Chapter 1).
 - Pull off the water connection of the coupling bellows.
- Loosen the three red Allen screws ([→] /Fig. 2).
- Carefully pull the shock wave head upward to remove it.

∆CAUTION

There will still be water in the shock wave head.

- Replacing/Assembly the shock wave head: Chapter 5, page 3.
- Replacing the cone drive: Chapter 5, page 2.

5 - 2 Replacing the shock wave head and cone drive



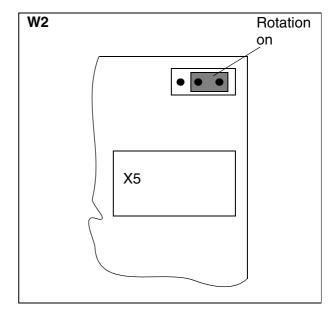


Fig. 3

Fig. 4

Cone drive replacement

NOTICE

The cone drive with the rotation motor is delivered without a cone tube cover cap. The installation procedure for the cover cap is described below.

- Desolder the cable at switch S28 and disconnect the plug Sk.X1 and Sk.X2 from the cone drive on board W2.
- Remove the five Allen screws (⁷ /Fig. 3) and pull the old cone drive downward to remove it.
- Clean the contact surfaces betwen the cone drive and support system with fine sandpaper and grease them slightly (e. g. Esipast).
- Attach the new cone drive. Reconnect cables Sk.X1 and Sk.X2.
- Solder the cable back onto switch S28. Make sure that the solder joint does not contact the shock head support.
- If the ULTRASOUND option is present:
 - Remove the jumper from switch S42 (cone drive rotation), if present, or connect jumper X42 on board W2 in the cone drive (Fig. 4).



Attach the cap and rubber ring carefully, as these parts are very fragile.

- Install the cap on the cone tube, making sure that the cap flange is positioned in the groove of the tube. Be careful not to damage the cap.
- Pull the rubber ring over the cap until it slides into the groove.
- If the screws for the shock wave head are not accessible, the cone drive can be moved
 by turning one of the three spindles using a screwdriver. The screwdriver must be
 applied to the spindle from below. Record the serial number of the cone drive.

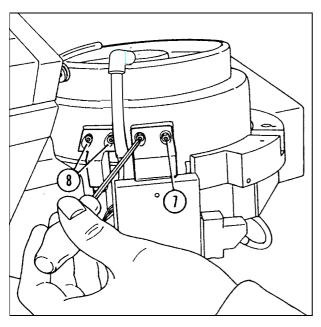


Fig. 5

∆CAUTION

Check the connections on the high-voltage socket. If there is any damage, the high-voltage socket must be replaced.

Assembly

- Remove any residual water from the shock wave head holder, if necessary.
- Clean the contact surfaces between the cone drive and shock wave head with fine sandpaper and grease them slightly (e. g. Esipast).
- Carefully lower the shock wave head and secure it with the three red Allen screws.
- When installing the shock wave head pay attention to good connection of the contact springs between shock wave head and cone drive.

After replacing the shock wave head

 Install the coupling bellows according to chapter 1.

After replacing the cone drive

- Plug in the water connection of the coupling bellows.
- Attach the clamp (8/Fig. 4 in chapter 1).
- Install the covers (4/Fig. 2 in chapter 1).
- Re-tighten the connection (8/Fig. 5) and the sensor module (7/Fig. 5).

∆CAUTION

Tighten them by hand only.

- Switch off N12 with switch S1.
- System ON.

5 - 4 Replacing the shock wave head and cone drive

- Place the adjustment phantom in position.
- Ensure that the isocenter adjustment is still correct. If not, correct it according to the "Isocenter Adjustment" instructions RXL2-120.071.01...
- Remove the adjustment phantom.
- System OFF.
- Attach the shock wave head cover (see Chapter 1).
- System ON.
- Fill the cooling and coupling circuits according to Chapter 1.
- Generate coupling pressure and release a few shock waves.
- Ensure that the cone cap and coupling bellows are tightly sealed:
 Use a long, blunt object (e.g. the handle of a 30 cm long screwdriver) to carefully press
 the cone tube against the cone cap. This further tightens the cone cap and will stretch
 any potentially damaged areas. Water will then flow out, in which case the cap must be
 replaced.
- Connect the service PC to the LITHOSTAR Multiline and logon.

Shock wave head replaced	Cone drive replaced
 Read out the shock counter in the shock wave head monitor and record it in the operating record (Logbook Register 8) Reset the shock counter: Parameter Group Interface Shock wave system 	Ensure that the parameters are correct for parameter groups am8 and am9, (correct parameters are in the instructions RXL2-120.032.02 Software Parameter / Monitoring)

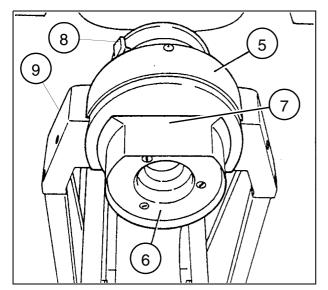
- Disconnect the service PC.
- Perform pressure measurement according to Chapter 2 Shock Wave Pressure and Position Control service instructions SPL2-120.074.01.
- System OFF.

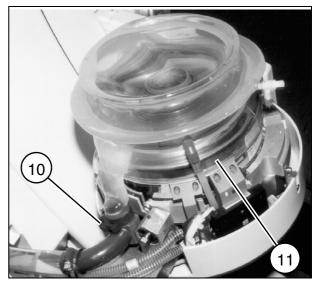
Checking the toothed belt

NOTICE

It is recommended to check the toothed belt for the cone longitudinal drive each time the shock wave head is replaced. The tube drive must be replaced any time the toothed belt is damaged.

- Lift the toothed belt slightly at the marked spots (1/Fig. 3) until the surface is visible.
- With a screwdriver, turn the toothed belt further from below with one of the three spindles (1/Fig. 2) in this manner, check the entire length.





Replacing the cone tube cap

System ON.

Fig. 6

- Move the C-arm to the 0° position.
- Move the shock wave head into the gel position.
- Remove the lower cover (6/Fig. 6) of the shock wave head.
- Remove the safety cover (9/Fig. 6).
- Empty the shock wave head (refer to chapter 1).
- Remove the elbow pipe (8/Fig. 6) from the coupling bellows.
- Remove the clamp (10/Fig. 7) and pull off the water connection of the coupling bellows.

Fig. 7

- Remove the tensioning band found below the collar (11/Fig. 7); to do so, the collar must be bent upwards.
- Remove the coupling bellows from the shock wave head.
- Rotate the cone upward by turning one of the three spindles with a screwdriver until the rubber ring becomes accessible.
- Remove the rubber ring.
- Remove the cap.
- Check the cone tube for any sharp edges or contamination; deburr with fine emery paper (grain size 380 or finer), if necessary.
- Remove any residual poly gel from the cone tube.

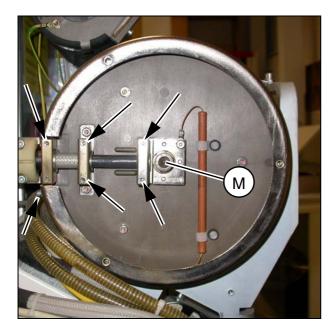
∆CAUTION

Attach the cap and rubber ring carefully, since these parts are very fragile.

 Attach the new cap, making sure that the flange of the cap rests in the groove of the cone. Be careful not to damage the cap.

5 - 6 Replacing the shock wave head and cone drive

- Pull the rubber ring over the cap until it slides into the groove.
- Mount the coupling bellows, ensuring its correct positioning. The connection for the
 pressure sensor (elbow) in the coupling bellows must be congruent with the lens
 opening.
- Reinsert and lock the elbow pipe.
- Reconnect the water connection of the coupling bellows, using the clamp (10/Fig. 7) to secure.
- Refill the shock wave head as described in chapter 1.
- Check the cone cap and coupling bellows for leaks:
 Use a long, blunt object (e.g. the handle of a 30 cm long screwdriver) to carefully press
 the cone tube against the cone cap. This further tightens the cone cap and will stretch
 any potentially damaged areas, causing water to flow out.
- Reattach the lower shock wave head housing cover and the safety cover.



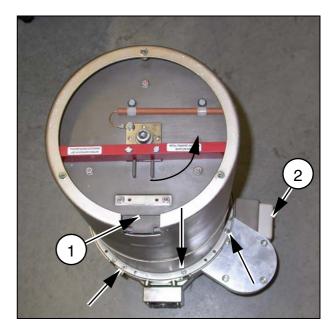


Fig. 1 Fig. 2

Removing the old shock wave generator

- Remove the cover plate of the shock wave generator.
- Loosen the screws (\(\simeg\) /Fig. 1) and cable clamps.
- Remove the high-voltage cable.
- · Loosen all other cables.
- Remove the shock wave generator from the holder.

Installing the new shock wave generator

- Place the new shock wave generator in a vertical position (Fig. 2).
- Loosen the screw (M/Fig. 1) a little, but do not remove it.
- Unscrew the seven screws (↘/Fig. 2) (not all screws visible in the figure).
- Turn the top part of the generator 90° counterclockwise in relation to the bottom part (Fig. 3) so that the high-voltage connection later points to the left with the shock wave generator installed (Fig. 1).
- The connection (1/Fig. 2) is then positioned above the trigger transformer (2/Fig. 2).
- Screw the seven screws (\(\simeg\) /Fig. 2) (not all screws visible in the figure) back in again.
- Retighten the screw (M/Fig. 1).
- Place the shockwave generator into the holder.
- Remove the transport safety device.
- Fasten the high-voltage cable to the new shock wave generator with the fastening parts of the old generator.
- Make all other cable connections.





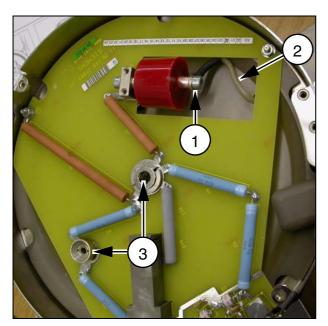
Fig. 3 Fig. 4



Fig. 5

Replacing the trigger transformer

- Remove the shock wave generator and the seven screws (→/Fig. 4) (not all screws visible in the figure).
- Carefull pull off the upper part of the shock wave generator.
- Remove the screws (1/Fig. 5).



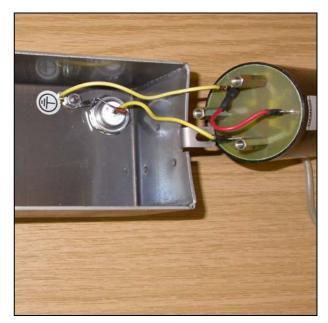


Fig. 6 Fig. 7

- Remove the screw (1/Fig. 6). Remove the housing with built-in trigger transformer from the shock wave generator. Pull the cable (2/Fig. 6) carefully through the opening in this case.
- Remove the three screws (2/Fig. 5) on the housing and remove the trigger transformer.
- Pull the cable off and plug it in to the new trigger transformer (Fig. 7). Insert the trigger transformer back in the housing.
- Run trigger cable through opening to the connection point (1/Fig. 6) and fasten there with the screw.
- Set the trigger transformer back on the shock wave generator and fasten it with the screw (1/Fig. 5).
- Set the upper part back on, make sure that the connection pins engage in the socket (3/Fig. 6).
- Tighten the screw (→/Fig. 4) again.

Replacing the Shock Wave Generator

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Replacing the water pump M15

- Replace the defective pump.
- Insert the new pump (is only attached in the front of the cabinet).
 - If the water hoses (couplings) cannot be attached to the pump, push the couplings that come with the pump on to the hoses and secure with clamps.
- Fill the cooling circuit according to Chapter 1.

Replacing the filter holder

- Loosen the two hoses on the old filter.
- Remove the four mounting screws and pull it downward.
- Remove the four mounting screws on the new filter.

∆CAUTION

Do not hold the filter by the venting valve.

- Install the new filter.
- For systems with serial numbers up to and including 07114.
 - Slide the couplings delivered with the filter on the hoses and tighten with clamps before placing them on the filter.
- Fill the cooling circuit according to Chapter 1.

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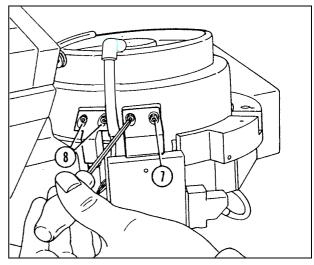


Fig. 1

- Remove the shock wave head cover (refer to Chapter 1).
- Remove the sensor module (7/Fig. 1) by removing the screws.
 - The cooling water will drain out of the shock wave head.
- Disconnect the plug from pump M15 (do not run the pump without water).
- Replace the sensor module, but do not tighten it yet.
- Switch on module N 12.

NOTICE

There are two different versions of board W11. The measurement point designations are different for each version.

Board W11 with AS00 and AS01

- Connect a multimeter to board W11A at measurement point X3 (0V on board D1.X3).
- Check voltage 0 V ± 10 mV and adjust with R22, if necessary.
- Measure the room temperature.
- Connect the multimeter to board W11A at measurement point X2 (0V on board D1.X3).
- Check whether the measured voltage agrees with the temperature value in the following table: Voltage tolerance ± 30 mV; adjustable with R13 on board W11A.

° C	18° C	19° C	20° C	21° C	22° C	23° C	24° C	25° C	26° C
Volt	4.51 V	4.70 V	4.90 V	5.10 V	5.29 V	5.49 V	5.69 V	5.89 V	6.09 V
°F	64° F	66° F	68° F	70° F	72° F	73° F	75° F	77° F	79° F

° C	27° C	28° C	29° C	30° C	31° C	32° C	33° C	34° C	35° C
Volt	6.29 V	6.49 V	6.69 V	6.89 V	7.09 V	7.29 V	7.49 V	7.69 V	7.90 V
°F	81° F	82° F	84° F	86° F	88° F	90° F	91° F	93° F	95° F



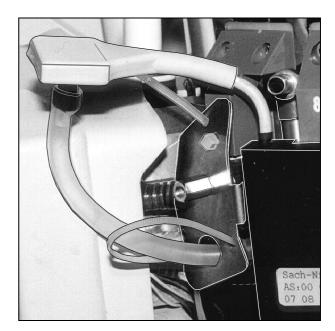


Fig. 2 Fig. 3

Board W11 as of AS02

- Connect a multimeter to board W11A at measurement point X2.3 (0V on board D1.X3).
- Check voltage 3V ± 10 mV and adjust with R22, if necessary.
- Measure the room temperature.
- Connect the multimeter to board W11A at measurement point X2.2 (0V on board D1.X3).
- Check that the measured voltage agrees with the temperature value in the following table:

Voltage tolerance ± 30 mV; adjustable with R13 on board W11A.

° C	18° C	19° C	20° C	21° C	22° C	23° C	24° C	25° C	26° C
Volt	4.36 V	4.53 V	4.69 V	4.85 V	5.01 V	5.17 V	5.33 V	5.50 V	5.66 V
°F	64° F	66° F	68° F	70° F	72° F	73° F	75° F	77° F	79° F
° C	27° C	28° C	29° C	30° C	31° C	32° C	33° C	34° C	35° C
Volt	5.82 V	5.98 V	6.14 V	6.31 V	6.47 V	6.63 V	6.79 V	6.95 V	7.11 V
°F	81° F	82° F	84° F	86° F	88° F	90° F	91° F	93° F	95° F

- Switch module N 12 off.
- Reconnect the plug to pump M 15.
- Attach the sensor module (7/Fig.1) tightly (handtighten only); with the O-ring.
- Secure both hose ends at approximately the same height and fill the hose with water using a syringe (without needle) (Fig. 2).
- Connect the hose to the sensor (Fig.3); making sure that the water in the hose does not leak out.

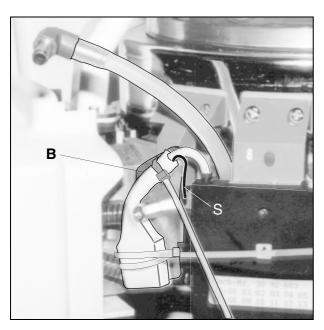
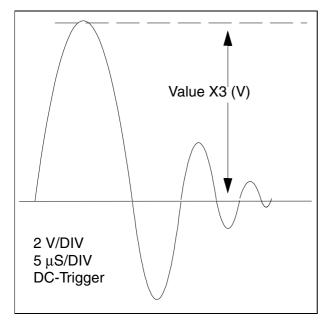


Fig. 4

- Secure the sensor to mounting plate B with both cable ties (Fig. 4).
- Route the thin hose (S) exiting the sensor so that the opening points downward and ensure that it is not kinked. If water enters the hose, the sensor will be damaged.
- Switch on module N12.
- Install the shock wave head (Chapter 1).
- Connect the multimeter to board W12 at measurement point X3.1 (0V on board D1.X3).
- Check voltages 1.0 V & 0.01 V at measurement point X3.1 and adjust with R71, if necessary.
- Fill the cooling circuit (Chapter 1).
- Fill the coupling circuit (Chapter 1).
- Move the W-drive into the gel position.
 - The coupling bellows is full.
 - The LED V23 on board W12 must light up. If it doesn't, perform a complete adjustment to board W12 as described in chapter 3.
- · Activate decoupling,
 - The LED V22 on board W12 must light up. If it doesn't, perform a complete adjustment to board W12 as described in chapter 3.
- Move the shock wave head into the park position.
- System OFF.

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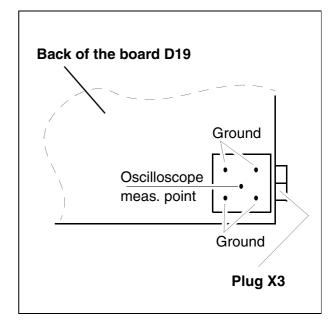


Fig. 1 Fig. 2

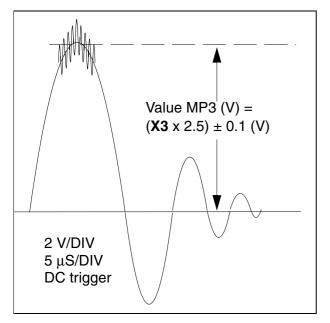
Determining voltage value X3

- Place board D19 on the extension.
- System **ON**.
- Connect the digital multimeter to board D19 at MP2 and MP_{GND}.
- Select the energy level which corresponds to 15.1 kV ± 0.2 kV of the charging device display.
- Set 3.0 V \pm 0.03 V with R7A on board D19.
- Connect the oscilloscope to board D19 at the measurement points of connector X3:
 - Connect ground to plug X3 as well to avoid interference during the measurement (Fig.2).
 - Connect the external trigger to board D19.z16.
 - Set 2 V / division, 5µs / division.

NOTICE A BNC cable

A BNC cable and a BNC tee can also be used on plug X3.

- Release shock waves at the energy level which corresponds to 15.1 kV ± 0.2 kV.
- Measure the voltage at plug X3 and record it as value X3. Refer to (Fig. 1) for the wave form.



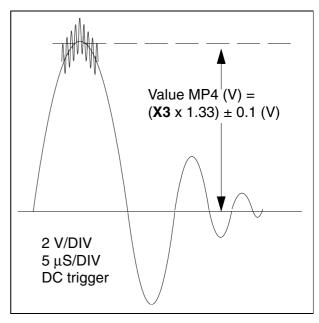


Fig. 3 Fig. 4

Setting the voltage values on MP3 and MP4

- Connect the oscilloscope to D19 at MP3, ground to D19 at MP_{GND}.
 - Connect the external trigger to board D19.z16.
 - Set 2 V/division, 5µs/division.
- Release shock waves at the energy level which corresponds to 15.1 kV \pm 0.2 kV on the charging device display.
- Minimize the spikes with the trimmer (Fig. 3).
- Set a value of (X3 x 2.5) ± 0.1 V at measurement point MP3 with potentiometer R47 on board D19 (Fig. 3).
- Connect the oscilloscope to D19 at MP4, ground to D19 at MP_{GND}.
 - Set 2 V/division, 5µs/division.
- Release shock waves at the energy level which corresponds to 15.1 kV \pm 0.2 kV.
- Set a value of (X3 x 1.33) ± 0.1 V at measurement point MP4 with potentiometer R60 on board D19 (Fig. 4).
- System OFF.
- Remove board D19 from the extension and reinstall it.

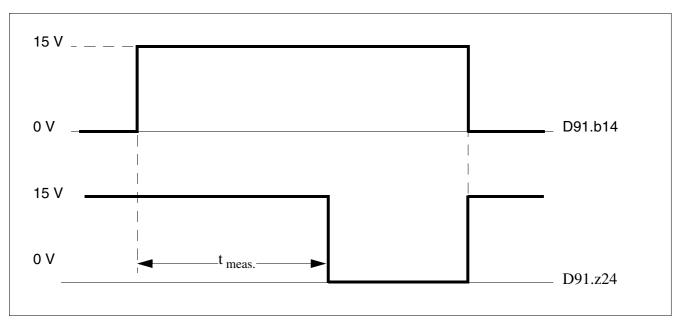


Fig. 1

Determining the current charging time (t_{meas.})

NOTICE

Charging times may vary according to the charging device and the shock wave generator.

- Place board D91 on the extension.
- Switch the system ON.
- Set the maximum energy level.

• Connect the Channel 1 to D91.b14 (start charging) oscilloscope:

Channel 2 to D91.z24 (end charging)

0 V to D91.b2

• Set the oscilloscope: 5 V/Div

50 ms/Div

Trigger on channel 1

- Release shock waves.
- Determine the charging time (t_{meas.}) and record the value (Fig. 1).

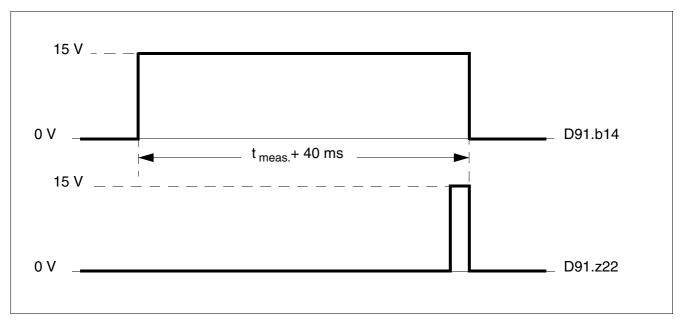


Fig. 2

Setting the monitoring time (t_{meas.} + 40 ms)

• Connect the Channel 1 to D91.b14 (start charging)

oscilloscope:

Channel 2 to D91.z22 (charging time limit)

0 V to D91.b2

• Set the oscilloscope: 5 V/Div

50 ms/Div

Trigger to channel 1

- Switch off the charging device at the circuit breaker.
- Actuate the manual release.
 - The yellow LED V20 (charging time exceeded) lights up briefly.
- Set the time t_{meas.} + 40 ms (max. 180 ms) with potentiometer R38 on board D91 (Fig. 2).
- After each measurement, reset the error with button S1 on board D91.
- Repeat the measurement until the time is correctly set.
- After correctly setting the charging time, switch the charging device back on.
- Check whether the monitoring device on board D91 responds at the different energy levels.
- System OFF.
- Remove board D91 from the extension.

Chap. 0 Cover sheet, Revision status, Table of contents newly generated.

Chap. 5 - 4 Checking the toothed belt added.

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